

IN THE UNITED STATES PATENT

AND

TRADEMARK OFFICE

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APPLICATION OF

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ON

DRILLING RIG ELEVATOR SAFETY SYSTEM

DRILLING RIG ELEVATOR SAFETY SYSTEM

This invention pertains to apparatus to indicate the status of safety features on an oil field elevator. More particularly, it pertains to apparatus to indicate at the derrick floor a condition which prevents opening of elevator slips when the pipe string load is not present on the elevator slips.

BACKGROUND OF INVENTION

Most oil field elevators are lifted by bails from a traveling block and lift pipe that passes vertically through an opening extending along the elevator general centerline. Such elevators usually have doors, open like a book, or have a closed peripheral body containing a slip bowl in which slips operate to grip pipe. Slips are effectively wedged and the force of gripped pipe pulls the slips downward in the funnel shaped slip bowl to assure inward wedging of the slips to securely grip pipe. This invention relates to slip equipped elevators.

Oil field elevators that have to lift slips to release pipe strings suspended by the elevator are usually not capable of releasing pipe strings that are pulling down on the slips. To lift the slips and release the pipe considerable upward force is required to first lift the pipe string and then lift the slips.

The apparently reliable fail-safe system can sometimes fail under certain circumstances. Pipe strings have been dropped into wells because the pipe string, moving downward in the well, encountered brief resistance to movement and the elevator moved downward relative to the pipe. Moving upward relative to the elevator, the pipe weight no longer urged the slips closed. That allowed the slips to move upward and create a condition to drop the pipe. To avoid such accidents, a safety latch was provided to lock the slip control in the slips-down position. From the drilling floor, however, it is not easy to determine if the safety latch is in the safe position and some accidental drops continued to occur.

There is a need to provide a driller level indicator that the slip safety latch is in the safe position. There is a further need to avoid adding to the wires that already descend from various derrick apparatus to the drilling floor. In addition, the safety feature should be workable without time consuming drilling rig modifications. The needs represent objectives in pursuing the development of the present invention.

SUMMARY OF INVENTION

The elevator to be fitted with the present invention will have an element that moves in sympathy with the slip relative to the elevator body. That element is fitted with an elevator mounted lock system that immobilizes the element and prevents accidental opening of the slips. A switch that cooperates with the element senses the locked safe position of the slips and provides a signal. The signal activates an elevator mounted transmitter that emits a wireless signal that travels to a receiver on the rig floor, or drillers location. The receiver, in turn, produces an output signal that can be detected by the driller. The driller may be human or contrivance capable of reacting to the signal to carry out appropriate activities. The nature of the signal is selected in light of the nature of the driller expected to respond to the signal.

These and other objects, advantages, and features of this invention will be apparent to those skilled in the art from a consideration of this specification, including the attached claims and appended drawings.

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 is a side view, generally symbolic, of an elevator lifting a pipe string and fitted with the safety apparatus of this invention.

Figure 2 is a side view, generally symbolic, of an elevator with the cooperating functional features related to the invention, when the elevator slips are set for lifting.

Figure 3 is similar to figure 2 but showing the elevator slips in the open situation.

DETAILED DESCRIPTION OF DRAWINGS

Figure 1 is a symbolic representation of the common drilling activity in which elevator 1 is used to suspend pipe string 2 in a well extending below rig floor 10. No traveling block is shown suspending elevator 1 in the derrick, also not shown. Lever 5 or the equivalent is used to lift and lower the slips in elevator 1. Safety lever 4 is moved, as indicated by arrows, to enable the movement of lever 5. Unless lever 4 is in a selected position, lever 5 can lift the elevator slips and drop a pipe string. Further, the slips can be lifted by an upward force that results from brief release of the pipe string load. By processes described later herein, a selected position of lever 4 locks the slip lifting system and causes a signal to be sent to transmitter 3. Transmitter 3, by electromagnetic or sonic emissions 6, causes the receiver 9 to produce a signal 8 detectable by a driller as an indication that lever 4 is in the selected position. The driller may be human or machine and the signal is made detectable in light of the nature of the driller.

By design choice, the indicator 8 is used to indicate a safe (slips closed and locked) condition so that a system failure, producing no signal, will not indicate a safe condition. Further, by choice, emission 6 is a radio frequency emission.

Figures 2 and 3 symbolically show the general linkage equivalent to that in most elevators using slips and having a slip operating lever. Above link 5c, all movements and pivot axes are symbolic and the position of elements such as slips 1a do not suggest graphic relationships to other elements. The dotted box represents the elevator general embodiment. Slip operating lever 5 has components or extensions 5a, 5b, and 5d. Principal components and functions shown are common or usable on most slip equipped elevators. For elevators using levers to actuate the slips, linkage 5c, or an equivalent, enables the use of the safety latch and the position indicator illustrated. Some elevators have no link 5d and lift slips by way of notches that engage lever extension 5b. Enabling link 16 is slidably attached to the elevator frame. Rocker 14 is pivotably attached to the elevator by stud P1. Over-center toggle bias link 13 is pivotably attached to the elevator by stud P2. P3 is the toggle pivot point

1 on rocker 14. Handle 4 is the manually movable part of rocker 14. The notation A
2 refers to attachment means to secure parts to the elevator body. Lever 5 consists of
3 parts that pivot about elevator body attachment stud P4. Link 5d is often replaced
4 by a slot in the slips that capture lever part 5b.

5 The slip closed position is shown by fig. 2. By choice, the switch 11 is
6 actuated by rocker 14 in this position and it closes a circuit 12 to actuate transmitter
7 3. The elevator is movable relative to the receiver 9 which is usually near the driller
8 on the rig floor. Transmitter 3 sends a signal 6, preferably radio frequency
9 electromagnetic, to receiver 9 which emits an indication 8, preferably a light, in
10 response. By observing light 8, the driller knows the elevator slips are closed. In
11 light intensive situations, semaphore-type elements or the equivalent may serve as
12 indicators.

13 To open the slips 1a, rocker 14 is rotated clockwise by moving handle 4
14 downward. Locking lug 14a moves out of engagement notch 16a allowing enabling
15 link 16 to move downward, in sympathy with lifting of slips 1a, when the pipe string
16 load on the slips is lifted. Engagement notch 16a is too short for locking lug 14b to
17 move immediately into the most clockwise position. The toggle bias 13 continues to
18 urge the lug 14b against link 16 until link 16 is in the downward position that exists
19 when the slips are lifted to the open position. Then, lug 14b moves to lock link 16
20 downward, and that locks the slips in the open position. A switch such a 11 can be
21 situated to respond to the locked-open slip position and set in motion a preselected
22 indicator that is not easily confused with the slips closed and locked indication.

23 When the slips are to be closed, or set, handle 4 is moved upward. Lug 14b
24 comes out of notch 16a and link 16 is free to move upward, allowing the slips to
25 move into the closed position, usually urged in that direction by movement of lever
26 5. Until the slips are fully downward to the set position, toggle bias 13 applies a
27 counter-clockwise force on rocker 14 but lug 14a cannot enter the short notch 16a
28 until link 16 is in a fully upward position which attends the slips set position. A
29 danger period exists after handle 4 is moved upward to lock the slips, and after lever

1 5 is moved to set the slips, but before the slips do set allowing lug 14a to enter notch
2 16a . Switch 11 is set such that it will not actuate until lug 14a enters notch 16a,
3 which allows rocker 14 to move the final amount. Locking action is indicated by L1.
4 When lug 14b enters notch 16a the lock situation L2 exists. That position prohibits
5 closing of the slips and an indicator is not usually required.

6 A second danger period exists if rocker 14 is rotated enough for lug 14b to
7 allow link 16 to move upward but the rocker is not moved enough for toggle bias 13
8 to go over center and urge lug 14a into notch 16a. In that situation, the slips may be
9 safely supporting the pipe string but if the pipe string load is relieved briefly by such
10 as ledging the downwardly moving pipe string, the slips can suddenly be urged
11 upward by drag on the suddenly stopped drill string. Upward movement of the slips
12 can drop the pipe string into the well. That can destroy a drill string and jeopardize
13 the related well. Switch 11 will not be actuated in this period.

14 Transmitter 3, by choice is a battery operated contrivance, eliminating the need
15 for power conductors extending to the elevator to serve the transmitter. The
16 transmitter and receiver are available off the shelf and need only ruggedized cases
17 for the intended purpose.

18 The configuration shown by the drawings represents an apparatus arranged to fit and
19 serve an existing elevator on hand. The rotation and sliding elements of the apparatus have
20 generic equivalents of several forms. Such alternate forms are well known to those skilled
21 in the art. The choices of elements indicated resulted from conveniences in construction
22 related to machines on hand and are not to be construed in a limiting sense.

23 From the foregoing, it will be seen that this invention is one well adapted to
24 attain all of the ends and objects hereinabove set forth, together with other
25 advantages which are obvious and which are inherent to the apparatus.

26 It will be understood that certain features and sub-combinations are of utility
27 and may be employed without reference to other features and sub-combinations. This
28 is contemplated by and is within the scope of the claims.

29 As many possible embodiments may be made of the apparatus of this invention

1 without departing from the scope thereof, it is to be understood that all matter herein
2 set forth or shown in the accompanying drawings is to be interpreted as illustrative
3 and not in a limiting sense.